Space Weather Technical Forecast

Issued on Sunday, 09 April 2023 at 01:16 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

---

Space Weather Forecast Headline: Chance of M-class flares (R1-R2 Minor-Moderate radio blackouts) throughout.

Analysis of Space Weather Activity over past 24 hours
Solar Activity: Solar activity was Moderate with an impulsive peak flare M2.9 associated with AR3272 in the southeast and a number of C-class flares. This region continues to move into a clearer viewing angle with ongoing development visible, although overall growth appears to have slowed somewhat. AR3272 is one of two sunspots on the disc, with AR3270 a simpler and mostly stable spot now approaching the southwest horizon. There are a number of filaments on the Earth-facing disc with multiple small CMEs observed over the last 24 hours, however these were all assessed as off the Earth-Sun line. No Earth-directed CMEs have been observed in available imagery.

Solar Wind / Geomagnetic Activity: Solar wind speed at L1 was generally at background 350-400 km/s with below average density. The total IMF, Bt, was weak, persisting below 6 nT, with the north-south component, Bz, oscillated weakly between +5 and -5 nT. The Phi angle was primarily negative (towards the Sun). Geomagnetic activity was Quiet (Kp0-2).

Energetic Particles / Solar Radiation: High energy proton flux (greater than 10MeV), as measured at GOES16, was at background. The high energy electron flux (greater than 2MeV), as measured at GOES16 was mainly moderate, but briefly high, with a peak of 2510pfu at 08/1515 UTC. The associated 24 hour fluence was below the Active threshold. The 09/0001 UTC observed was 7.75e7 integrated pfu.

Four-Day Space Weather Forecast Summary
Solar Activity: Low to Moderate activity is expected, with an ongoing chance of M-flares (R1-R2 Radio blackouts) most likely from AR3272 in the southwest disc.

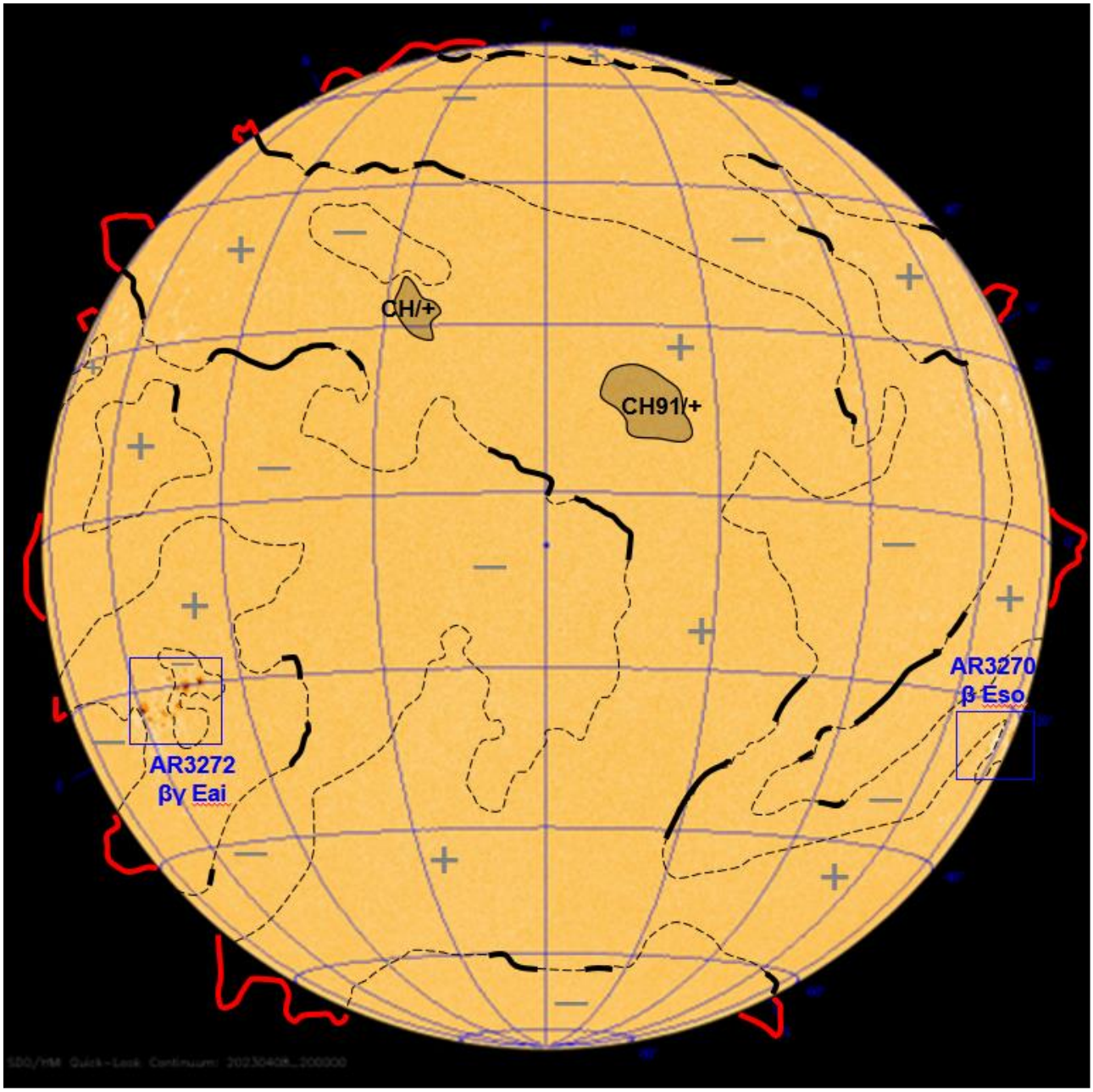
Solar Wind / Geomagnetic Activity: There are no Earth-directed CMEs, with the filament eruption from around 07/0800 UTC expected to miss, passing ahead and to the south of Earth later day 3 or day 4 (11-12 Apr). Although there is a very slight chance of a glancing influence. Current background slow-winds are expected to persist until later on day 2 or into day 3 (10-11 April), when the arrival of the fast wind associated with the HSS of CH91/+ is possible. This is expected to bring only a muted enhancement to conditions, with slightly elevated winds. Geomagnetic activity is expected to be mainly Quiet day 1 (9 Apr), with a chance of rising to Unsettled with Active periods later day 2 (10 Apr) but more likely on day 3 (11 Apr), with this risk looking to continue into day 4 (12 Apr).

Energetic Particles / Solar Radiation: High energy (greater than 10MeV) proton flux is expected to persist at background levels. High energy (greater than 2 MeV) Electron flux will continue to be mainly Moderate with diurnal peaks of High possible, but with an overall declining trend. A more notable dropout is expected with the arrival of the fast winds later day 2 or day 3 (10-11 Apr). The associated 24 hour fluence is expected to remain below the Active threshold.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Figure 1. Solar Analysis Valid 08/2000 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Geomagnetic Storms:

There are no Earth-directed CMEs with the previously observed filament eruption on 07 April currently expected to pass south and ahead of Earth. There is a very low likelihood of a glancing interaction into the later part of day 3 or into day 4 (11-12 Apr), however significant influence on the geospace environment looks unlikely.

Current background slow-wind conditions are expected to persist until the potential arrival of any fast wind associated with the high-speed stream (HSS) of CH91/+. This may begin to influence the solar wind regime as early as day 2 (10 Apr) but more likely day 3 (11 Apr), with impacts continuing into day 4 (12 Apr). 27-day recurrence of this feature suggesting the potential for slightly elevated speeds of between 450-500km/s. However, as a positive polarity coronal hole, this is not favoured for a strong connection close to the March equinox (Russell-McPherron effect), with only relatively subdued geomagnetic activity expected.

Geomagnetic activity is expected to be mainly Quiet day 1, with a chance of rising to Unsettled with Active periods later day 2 (10 Apr) but more likely on day 3 (11 Apr), with this risk looking to continue into day 4 (12 Apr). This includes the potential for any glancing CME interaction.

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	5	10	10
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Nil

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

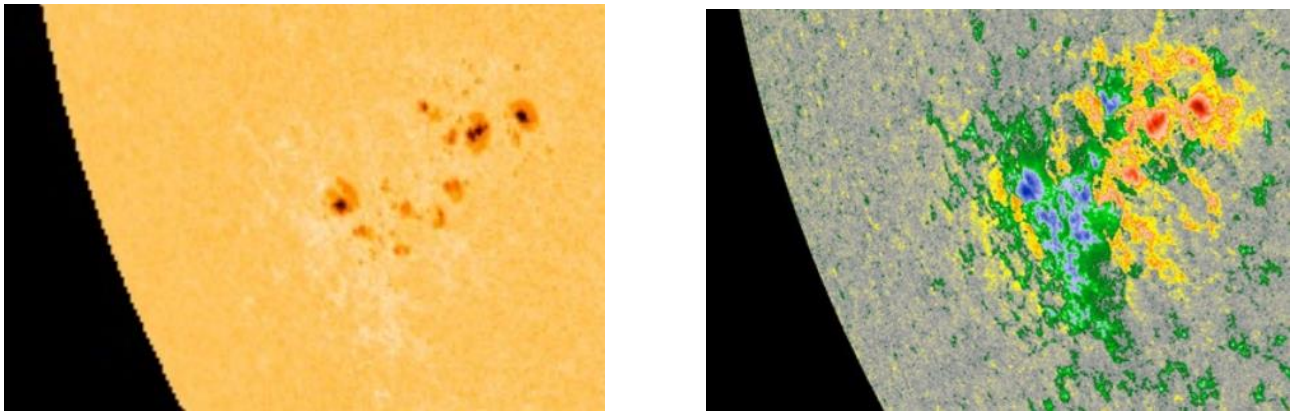
© Crown Copyright 2023. All Rights Reserved.

Radio Blackouts - X-Ray Flares:
Low to Moderate activity is expected with an ongoing chance of isolated M-flares, primarily due to AR3272 Eai/Beta-Gamma.

AR3272 is located in the southeast and one of only two regions currently on the disc. This has a rather ragged appearance, consisting of a number of small spots but with some ongoing development evident most notably around the main negative leader, with further growth of the region possible and the potential for rudimentary delta spot development. This was the source of two M-flares in the last 48 hours, and further similar flares are possible. The only other region currently on the disc AR3270 Eso/Beta, is a magnetically simpler region that is now approaching the southwest limb. This area expected to move off the visible disk during Day 1, this is unlikely to significantly lower the flare risk however.

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	30	30	30	30
Very Active	R3 to R5 X Class	No	5	5	5	5

Figure 2: SDO Hmi-intensitygram (left) and Magnetogram (right) of AR3272



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

Solar Radiation Storms - (High Energy Protons):
High energy proton flux (greater than 10MeV), as observed by GOES-16, is most likely to remain at Background levels pending any significant flares, with the risks just slightly elevated by the active regions currently on the disk.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	5	5	5	5
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.

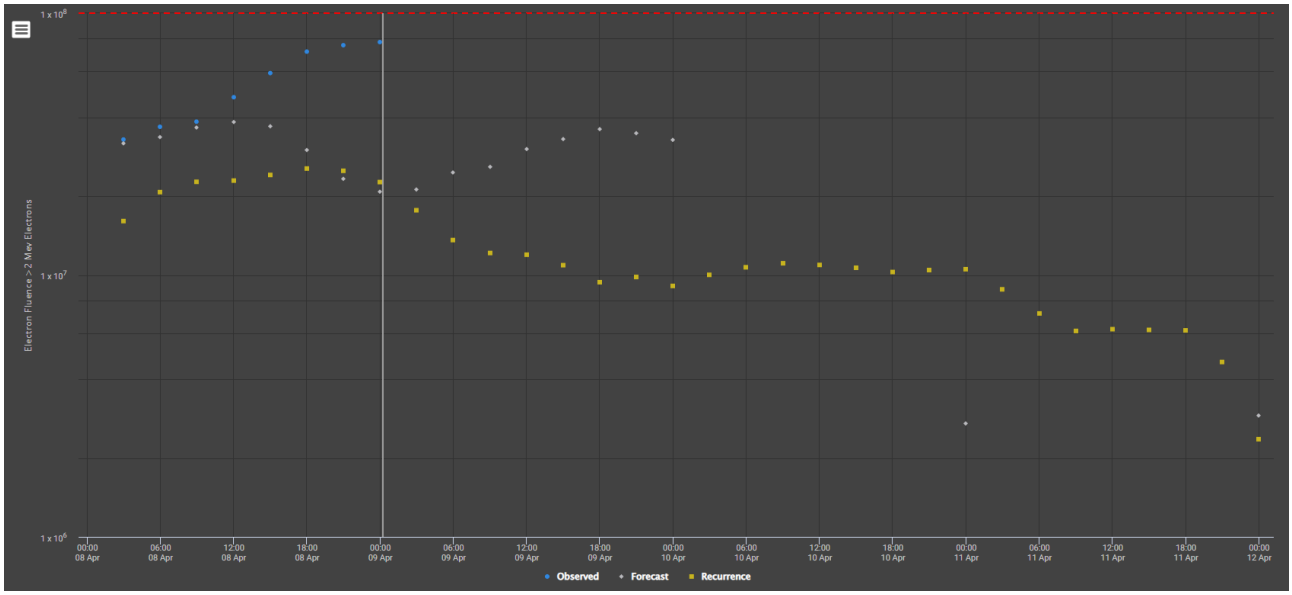
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2 MeV) as observed by GOES-16 is forecast to be mainly Moderate, but perhaps reaching High levels at diurnal peak periods. A general but erratic declining trend is expected to start the period. A more notable dropout is then expected later day 2 and into day 3 (10 and 11 Apr) due to the onset of the HSS of CH91/+,

The associated 24 hour fluence is expected to be remain below the Active threshold, gradually declining through days 1-2 (9-10 Apr). This is supported by REFM which is expected to give generally good guidance.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	10	5	5	5
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 3: Latest MOSWOC REFM model output showing expected trend downwards.



Issued by Met Office Space Weather Advisor, Tel: +44 (0) 330 135 4254 Email: moswoc@metoffice.gov.uk

© Crown Copyright 2023. All Rights Reserved.